IN THE CLAIMS:

Please amend the claims as follows:

1. (Currently Amended) A method for forming a patterned amorphous carbon layer in a multilayer stack, comprising:

depositing an amorphous carbon layer on a substrate by a process comprising:

providing a gas mixture to the deposition chamber, wherein the gas mixture comprises an inert gas and one or more hydrocarbon compounds;

maintaining the deposition chamber at a pressure between about 1 Torr to about 20 Torr; and

reacting the gas mixture to form an amorphous carbon layer;

depositing a silicon containing photoresist layer on top of the amorphous carbon layer;

developing a pattern transferred into the resist layer with an ultraviolet radiation photolithographic process; and

forming an in situ resist layer hard mask in an outer portion of the photoresist layer while etching through the amorphous carbon layer in at least one region defined by the pattern in the resist layer.

2. (Currently Amended) The method of claim 1, wherein ~~depositing the amorphous carbon layer comprises forming the layer with a chemical vapor deposition process~~ reacting the gas mixture comprises a plasma enhanced deposition process.

3. (Original) The method of claim 1, wherein depositing the silicon containing photoresist layer comprises forming the layer with a spin on deposition process.

4. (Original) The method of claim 1, wherein etching through the amorphous carbon layer comprises exposing the amorphous carbon layer to an oxygen based etchant.

5. (Original) The method of claim 4, wherein the oxygen based etchant chemically reacts with silicon in the silicon containing photoresist layer to form the resist layer hard mask.

6. (Original) The method of claim 5, wherein the resist layer hard mask has a thickness of less than about 1000 Å.

7. (Original) The method of claim 5, wherein the resist layer hard mask has a thickness of between about 50Å and about 1000 Å.

8. (Original) The method of claim 5, wherein the resist layer hard mask has a thickness of between about 75 Å and about 250 Å.

9. (Original) The method of claim 5, wherein the resist layer hard mask has a thickness of between about 100 Å and about 200 Å.

10. (Original) The method of claim 1, further comprising forming a material layer on the substrate with a chemical vapor deposition process prior to forming the amorphous carbon layer.

11. (Original) The method of claim 10, wherein the material layer comprises at least one of silicon dioxide and silicon nitride.

12. (Original) The method of claim 1, wherein the silicon containing photoresist layer comprises between about 3% to about 30% silicon.

13. (Original) The method of claim 1, wherein the silicon containing photoresist layer comprises between about 3% to about 10% silicon.

14. (Original) The method of claim 1, wherein the silicon containing photoresist layer comprises between about 5% to about 7% silicon.

15. (Original) The method of claim 1, wherein the silicon containing photoresist layer, the amorphous carbon layer, and the resist layer hard mask may be removed by a single etching process selective to these layers and leaving an underlying layer on the substrate.

16. (Canceled)

17. (Currently Amended) A method for patterning a material layer in a multilayer stack, comprising:

depositing an amorphous carbon layer on the material layer <u>by a process comprising:</u>

<u>providing a gas mixture to the deposition chamber, wherein the gas mixture comprises an inert gas and one or more hydrocarbon compounds;</u>

<u>maintaining the deposition chamber at a pressure between about 1 Torr to about 20 Torr; and</u>

<u>reacting the gas mixture to form an amorphous carbon layer</u>;

depositing a photoresist layer on top of the amorphous carbon layer;

developing a resist pattern transferred into the photoresist layer with an ultraviolet radiation photolithographic process;

forming an in situ resist layer hard mask in an outer portion of the photoresist layer while etching through the amorphous carbon layer in a patterned region defined by the resist pattern; and

etching through the material layer under the amorphous carbon layer using the patterned region etched into the amorphous carbon layer and the resist pattern.

18. (Canceled)

19. (Original) The method of claim 17, wherein forming the photoresist layer further comprises forming the photoresist layer having a predetermined quantity of silicon therein.

20. (Original) The method of claim 19, wherein forming the resist layer hard mask further comprises chemically reacting the predetermined quantity of silicon with an oxygen based etchant used to etch the amorphous carbon layer.

21. (Currently Amended) The method of claim 17, wherein the amorphous carbon layer and the material layer are deposited using ~~a chemical vapor deposition process.~~ a plasma enhanced deposition process.

22. (Original) The method of claim 17, wherein depositing the photoresist layer comprises using a spin-on deposition process.

23. (Previously Presented) The method of claim 17, wherein developing the resist pattern comprises utilizing a deep ultraviolet radiation photolithographic development process.

24. (Original) The method of claim 17, wherein etching through the amorphous carbon layer comprises applying an oxygen based etchant to the multilayer stack.

25. (Original) The method of claim 17, wherein forming the resist layer hard mask further comprises reacting silicon in the photoresist layer with an oxygen based etchant used to etch the amorphous carbon layer to form a silicon oxide layer in outer portions of the photoresist layer.

26. (Original) The method of claim 17, wherein the resist layer hard mask has a thickness of less than about 1000 Å.

27. (Original) The method of claim 17, wherein the resist layer hard mask has a thickness of between about 75 Å and about 250 Å.

28. (Original) The method of claim 17, wherein the resist layer hard mask has a thickness of between about 100 Å and about 200 Å.

29. (Original) The method of claim 17, further comprising removing the resist layer hard mask, the photoresist layer, and the amorphous carbon layer to expose a desired pattern in the material layer.

30. (Original) The method of claim 17, wherein forming the resist layer hard mask comprises reacting a first substance in the photoresist layer with a second substance in a chemical etchant to form the resist layer hard mask in an outer portion of the photoresist layer.

31. (Original) The method of claim 30, wherein the first substance comprises silicon.

32. (Original) The method of claim 30, wherein the second substance comprises oxygen.

33. (Original) The method of claim 19, wherein the predetermined quantity of silicon is between about 3% and about 30% silicon.

34. (Original) The method of claim 19, wherein the predetermined quantity of silicon is between about 3% and about 10% silicon.

35. (Original) The method of claim 19, wherein the predetermined quantity of silicon is between about 5% and about 7% silicon.

36-44. (Canceled)

Please add new claims 45-60 as follows:

45. (New) The method of claim 1, wherein the one or more hydrocarbon compounds have the general formula C_xH_y, and x has a range of 2 to 4 and y has a range of 2 to 10.

46. (New) The method of claim 45, wherein the one or more hydrocarbon compounds is selected from the group consisting of propylene (C_3H_6), propyne (C_3H_4), propane (C_3H_8), butane (C_4H_{10}), butylene (C_4H_8), butadiene (C_4H_6), acetelyne (C_2H_2), and combinations thereof.

47. (New) The method of claim 1, wherein the one or more hydrocarbon compounds is selected from the group consisting of propylene (C_3H_6), acetelyne (C_2H_2) and combinations thereof.

48. (New) The method of claim 1, wherein the amorphous carbon layer has a carbon:hydrogen ratio in the range of about 10 % hydrogen to about 60 % hydrogen.

49. (New) The method of claim 1, wherein the inert gas is selected from the group consisting of helium, argon and combinations thereof.

50. (New) The method of claim 1, wherein the gas mixture further comprises an additive gas selected from the group consisting of ammonia, nitrogen, hydrogen, and combinations thereof.

51. (New) The method of claim 1, wherein the substrate is heated to a temperature between about 100 ^{0}C and about 500 ^{0}C and the gas mixture is provided to the deposition chamber at a flow rate in a range of about 50 sccm to about 500 sccm.

52. (New) The method of claim 1, wherein the gas mixture is reacted by generating a plasma by a radio frequency (RF) power in a range of about 3 W/in^2 to about 20 W/in^2.

53. (New) The method of claim 17, wherein the one or more hydrocarbon compounds have the general formula C_xH_y, and x has a range of 2 to 4 and y has a range of 2 to 10.

54. (New) The method of claim 53, wherein the one or more hydrocarbon compounds is selected from the group consisting of propylene (C_3H_6), propyne (C_3H_4), propane (C_3H_8), butane (C_4H_{10}), butylene (C_4H_8), butadiene (C_4H_6), acetelyne (C_2H_2), and combinations thereof.

55. (New) The method of claim 17, wherein the one or more hydrocarbon compounds is selected from the group consisting of propylene (C_3H_6), acetelyne (C_2H_2) and combinations thereof.

56. (New) The method of claim 17, wherein the amorphous carbon layer has a carbon:hydrogen ratio in the range of about 10 % hydrogen to about 60 % hydrogen.

57. (New) The method of claim 17, wherein the inert gas is selected from the group consisting of helium, argon and combinations thereof.

58. (New) The method of claim 17, wherein the gas mixture further comprises an additive gas selected from the group consisting of ammonia, nitrogen, hydrogen, and combinations thereof.

59. (New) The method of claim 17, wherein the substrate is heated to a temperature between about 100 ^{0}C and about 500 ^{0}C and the gas mixture is provided to the deposition chamber at a flow rate in a range of about 50 sccm to about 500 sccm.

60. (New) The method of claim 17, wherein the gas mixture is reacted by generating a plasma by a radio frequency (RF) power in a range of about 3 W/in^2 to about 20 W/in^2.